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**REMARKS**

Claims 1-20 are currently pending in the application. By this amendment, claims 1, 4, 7 10, 11, 13, 14 and 16 are amended for the Examiner's consideration. Support for the amendments can be found in the claims, as originally filed, as well as in FIGS. 3 and 16 and the description thereof. Reconsideration of the rejected claims in view of the above amendments and the following remarks is respectfully requested.

***Allowed Claims***

Applicants appreciate the indication that claims 17-20 are allowed and claims 7-10 and 13-161 contain allowable subject matter. Claims 7, 10, 13, 14 and 16 are amended into independent form to include the subject matter of the respective base claim and any intervening claims. As such, claims 7-10 and 14-16 are also in immediate condition for allowance. Applicants submit, though, that all of the claims are in condition for allowance for the below reasons.

***35 U.S.C. §102/§103 Rejection***

Claims 1-6, 11 and 12 were rejected under 35 U.S.C. §102(e) for being anticipated by U.S. Publication No. 2003/0203319A1 to Lee. Claims 1-6, 11 and 12 were rejected under 35 U.S.C. §102(b) (or alternatively §103(a)) over U.S. Patent No. 6,136,679 to Yu. These rejections are respectfully traversed.

**Rejection of Claims 1 and 11 over Lee**

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See MPEP

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1 Applicants note that claim 13 was indicated as being objected to on the Office Action Summary. Also, claim 13 was not rejected under any prior art reference; however, page 3 of the office action does not list claim 13 as containing allowable subject matter. Applicants are assuming, though, that claim 13 includes allowable subject matter and, as such, has placed claim 13 into independent format to gain immediate allowance thereof.

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§2131. Applicants submit that the applied art does not show each and every feature of the claimed invention.

Claim 1 is amended to recite, in pertinent part:

depositing a memory layer on a substrate;  
memorizing a first edge of the memory layer; and  
memorizing a second edge of the memory layer by  
undercutting a sacrificial layer under the memory layer to define a  
loop of sub-lithographic well-controlled image size of memory  
material for image transfer.

Claim 11 is amended to recite, in pertinent part:

depositing a memory layer on a substrate;  
protecting the memory layer with a protective layer;  
defining a first edge in the memory layer and protecting  
other portions of the memory layer with the protective layer which  
are to be formed as a second edge by forming an undercut; and  
removing a portion of the protective layer to define the  
second edge in the memory layer.

Applicants respectfully note that the Examiner has not addressed the undercut feature, which was recited in rejected dependent claims. As such, Applicants request that the next action cannot be made final, as the Examiner has not addressed all of the features of the claimed invention. In any event, Applicants submit that these features are not shown in Lee. More particularly, Applicants submit that Lee does not show forming an undercut in order to, for example, memorize a second edge.

Specifically, Lee is directed to a method of fabricating sub-lithographic sized line and space patterns. This method includes depositing a first polysilicon layer 17 on a surface 6 of a base layer 13. Optionally, the base layer 13 can be connected with a substrate 11, e.g., a wafer of single crystal silicon. A photoresist layer 15 is deposited on a surface 12 of the first polysilicon layer 17. The photoresist layer 15 is then patterned by a lithographic system. As a result, the photoresist layer 15 is exposed with an image of the pattern (34, 35). As shown in FIG. 1b, the photoresist layer 15 is then etched to define a line 23 and space 24 pattern therein. As seen in

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FIG. 1b, there is no undercut formed at this stage of fabrication. In FIG. 2, the line and space pattern (23, 24) is transferred to the first polysilicon layer 17 by etching the first polysilicon layer 17 to define a plurality of polysilicon line features 21 and space features 20. Again, there is no undercut formed at this stage of fabrication. The line pattern 23 serves as an etch mask for an underlying layer of the first polysilicon layer 17.

In FIG. 3a, as reproduced below, the photoresist layer (i.e. the line pattern 23) is removed from the polysilicon line features 21. The polysilicon line features 21 are then oxidized in a plasma comprising an oxygen gas ( $O_2$ ). The oxygen gas oxidizes the polysilicon material of the polysilicon line features 21. The oxidation step continues until the polysilicon line features 21 are reduced G2 to a sub-lithographic feature size that is less than  $\lambda$  (i.e.  $\lambda$ ) and an oxidized mantel 22 of the polysilicon line features 21 has expanded G1 thereby reducing the space features 20 to the sub-lithographic feature size because as the oxidized mantel 22 expands as shown by arrows e, the space features 20 are reduced in width. Again, there is no undercut formed at this stage of fabrication.

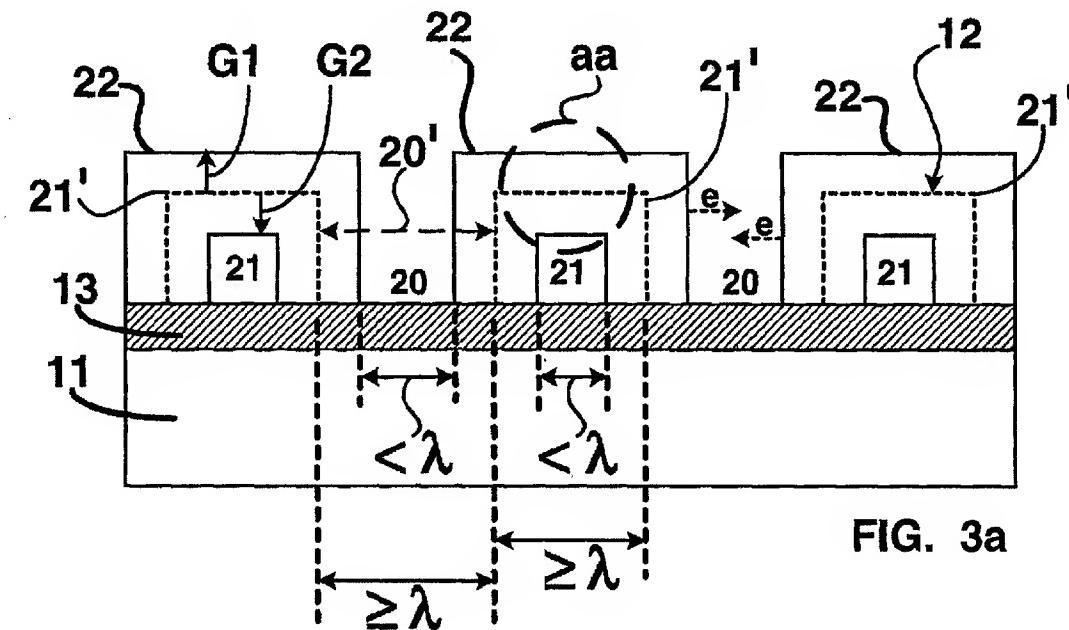


FIG. 3a

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Accordingly, Applicants request withdrawal of the rejection of claims 1-6, 11 and 12 over Lee.

Rejection of Claims 1 and 11 over Yu

Again, Applicants respectfully note that the Examiner has not addressed the undercut feature, which was recited in rejected dependent claims. As such, Applicants request that the next action cannot be made final, as the Examiner has not addressed all of the features of the claimed invention. In any event, Applicants submit that these features are not shown in Yu. More particularly, Applicants submit that Yu does not show forming an undercut in order to, for example, memorize a second edge.

Specifically, Yu shows a Gate micro-patterning process. The process includes thermally growing a layer of gate oxide (105) on the substrate. A polycrystalline silicon (polysilicon) layer (120) is next deposited over the gate oxide layer as shown in FIG. 2b. Referring to FIG. 2b, planarization layer (130) is deposited over the polysilicon or polycide layer (120). The dielectric planarization layer can be phosphosilicate glass (PSG), borophosphosilicate (BPSG), or a combination of BPSG and tetraethoxysilane (TEOS). An anti-reflective coating (ARC), layer (140), is deposited over planarized layer (130) with a thickness between about 150 to 1500 Å. When applied below the photoresist layer, the ARC is referred to as a bottom-ARC or BARC. It is preferred in the present invention that BARC layer (140) is formed over an already planarized layer (130). As a main feature and key aspect of the invention, a very thin layer of photoresist (150) is next formed over BARC layer (140) as shown in FIG. 2e. Then the photoresist layer is exposed and high resolution patterns (155) are formed in the thin layer as shown in FIG. 2f. These patterns, in turn, are precisely transferred into the underlying BARC layer, (140), forming a hard mask, designated as second hard mask shown in FIG. 2g. As seen in Fig. 2g, though, there is no undercut formed at this stage of fabrication, nor is there any suggestion to form an undercut.

In the first embodiment depicted in FIG. 2h, pattern (155) is further transferred into layer (130) while at the same time removing the thin layer of photoresist mask (150). At the next step,

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shown in FIG. 2i, conductive layer (120) is patterned with the image of the gate electrode patterned in the first hard mask to form the precisely defined gate, (125). It is another key aspect of the invention that the second hard mask in the BARC layer is removed at the same time the pattern is transferred from the first hard mask in the planarization layer into the conductive layer. The planarization layer is subsequently removed as shown in FIG. 2j. As seen in Fig. 2j, there is no undercut formed at this stage of fabrication, nor is there any suggestion to form an undercut.

In a second embodiment, the second and first hard masks are formed by etching through the BARC and planarization layers continuously using the high resolution photoresist mask a shown in FIG. 2k. Then, the photoresist mask and the second hard mask in the BARC, layers (150) and (140), respectively, are removed together at the same that the gate pattern is transferred from the second hard mask in layer (130) into conductive layer (120) resulting in a structure shown in FIG. 2l which is the same as FIG. 2i. Finally, planarization layer (130) containing the first hard mask is removed. The resulting structure is as shown in FIG. 2m which is the same as FIG. 2j of the first embodiment. Accordingly, like FIG. 2j, the embodiment shown in FIG. 2m does not have an undercut, nor is there any suggestion to form an undercut.

As to the obviousness rejection, Applicants submit that the examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness. See MPEP §2142. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.<sup>2</sup> Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the

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2 While the *KSR* court rejected a rigid application of the teaching, suggestion, or motivation (“TSM”) test in an obviousness inquiry, the [Supreme] Court acknowledged the importance of identifying “a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does” in an obviousness determination. *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 492 F.3d 1350, 1356-1357 (Fed. Cir. 2007) (quoting *KSR International Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1731 (2007)).

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reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

To this end, the Examiner has not met the initial burden of providing a prima facie case of obviousness. That is, the Examiner has not even addressed the feature of the undercut, which was recited, for example, in original claims 4 and 5. In any event, in order to advance prosecution of the present application, Applicants submit that Yu does not teach or suggest each of the features of the present invention, as discussed above.

Accordingly, Applicants request withdrawal of the rejection of claims 1-6, 11 and 12 over Yu.

**Dependent Claims 2-6 and 12**

Applicants submit that claims 2-6 and 12 are dependent claims, depending from a distinguishable independent claim. As such, Applicants submit that claims 2-6 and 12 are allowable for the same reasons as discussed above with respect to claims 1 and 11.

In addition, Applicants submit that the dependent claims include allowable subject matter, on their own merits. More specifically, none of the applied references disclose or suggest undercutting the sacrificial layer by one of chemical oxide removal and hydrofluoric acid to define the location of the second edge (claim 5) or the memorized first edge being defined by an edge of an upper layer comprising of Ge or organic spin-on material (claim 6).

***Complete Action Not Provided***

As discussed above, Applicants submit that the Examiner has not provided a complete action. More specifically, Applicants submit the Examiner never addressed many of the features of the claimed invention such as, for example, the formation of the undercuts. Additionally, Applicants submit that the Examiner has impermissibly grouped the claims together, without addressing each of the features of these claims. For at least these reasons, Applicants submit that

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a clear issue was not developed between the Examiner and Applicant. More specifically, MPEP §706 states:

Before final rejection is in order a clear issue should be developed between the examiner and applicant. To bring the prosecution to as speedy conclusion as possible and at the same time to deal justly by both the applicant and the public, the invention as disclosed and claimed should be thoroughly searched in the first action and the references fully applied; and in reply to this action the applicant should amend with a view to avoiding all the grounds of rejection and objection.

Additionally, MPEP 706.07(a) notes:

Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims nor based on information submitted in an information disclosure statement filed during the period set forth in 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17(p). ...

Furthermore, a second or any subsequent action on the merits in any application ... will not be made final if it includes a rejection, on newly cited art, other than information submitted in an information disclosure statement filed under 37 CFR 1.97(c) with the fee set forth in 37 CFR 1.17 (p), of any claim not amended by applicant or patent owner in spite of the fact that other claims may have been amended to require newly cited art.

Accordingly, Applicants respectfully requests that the Examiner address the untreated features of the claimed invention set forth in claims 1-6, 11 and 12, such that a clear issue is developed between the Examiner and Applicant. Moreover, Applicant submits that the next action, which should clarify the record, cannot be a final action.

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### CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicant hereby makes a written conditional petition for extension of time, if required. Please charge any deficiencies and credit any overpayment of fees to Attorney's Deposit Account No. 09-0456.

Respectfully submitted,



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